WHAT IS CLAIMED IS:

1. A substrate holder for supporting a substrate, comprising:

an exterior supporting surface;

a cooling component;

a heating component positioned adjacent to the supporting surface and between the supporting surface and the cooling component; and

a contact volume positioned between the heating component and the cooling component, and formed by a first internal surface and a second internal surface,

wherein a thermal conductivity between the heating component and the cooling component is increased when the contact volume is provided with a fluid.

2. The substrate holder of Claim 1, wherein the supporting surface, an operating surface of the cooling component, an operating surface of the heating component, the first internal surface, and the second internal surface are substantially parallel to one another.

3. The substrate holder of Claim 1, wherein a surface area of at least one of the first internal surface and the second internal surface is substantially equal to a surface area of the operating surface of at least one of the cooling component and the heating component.

4. The substrate holder of Claim 1, wherein at least one of the first internal surface and the second internal surface is rough.

5. The substrate holder of Claim 4, wherein the first internal surface and the second internal surface are in rough contact.

6. The substrate holder of Claim 1, wherein at least one of the first internal surface and the second internal surface is smooth.

7. The substrate holder of Claim 1, wherein a distance between the first internal surface and the second internal surface is between 1 micron and 50 microns.

8. The substrate holder of Claim 1, wherein the cooling component includes a plurality of fluid flow channels.

9. The substrate holder of Claim 1, wherein at least one of the first and second internal surfaces includes a plurality of fluid flow grooves and at least one fluid port.

10. The substrate holder of Claim 1, wherein the contact volume is sealed within the substrate holder.

11. A substrate processing system, comprising:

a substrate holder for supporting a substrate, including,

an exterior supporting surface,

a cooling component including a cooling fluid,

a heating component positioned adjacent to the supporting surface and between the supporting surface and the cooling component, and

a contact volume positioned between the heating component and the cooling component, and formed by a first internal surface and a second internal surface; and

a fluid supply unit connected to the contact volume, the fluid supply unit arranged to supply a fluid to the contact volume and to remove the fluid from the contact volume.

12. The system of Claim 11, further comprising a temperature control unit connected to the cooling component.

13. A substrate holder for supporting a substrate, comprising:

an exterior supporting surface;

a cooling component;

a heating component positioned adjacent to the supporting surface and between the supporting surface and the cooling component; and

first means for effectively reducing a thermal mass of the substrate holder to be heated by the heating component and for increasing thermal conductivity between a portion of the substrate holder surrounding the heating component and a portion of the substrate holder surrounding the cooling component.

14. The substrate holder of Claim 13, wherein the first means includes a contact volume positioned between the heating component and the cooling component.

15. The substrate holder of Claim 14, wherein the first means includes second means for evacuating a fluid from the contact volume and for providing a fluid to the contact volume.

16. A method for manufacturing a substrate holder, comprising the steps of:

providing an external supporting surface;

polishing at least one of a first internal surface and a second internal surface;

connecting peripheral portions of the first internal surface and of the second internal surface to form a contact volume; and

providing a heating component and a cooling component on opposite sides of the contact volume.

17. The method of Claim 16, further comprising the step of roughening at least one of a portion of the first internal surface and a portion of the second internal surface before the connecting step.

18. The method of Claim 17, wherein a distance between the roughened portions of the first internal surface and of the second internal surface is between 1 and 50 microns.

19. The method of Claim 16, wherein the peripheral portions of the first internal surface and of the second internal surface are made smooth.

20. The method of Claim 16, wherein the heating component is provided adjacent to the supporting surface.

21. The method of Claim 17, wherein a distance between the first internal surface and the second internal surface within the contact volume is between about 1 micron and 50 microns.

22. A method of controlling a temperature of a substrate, comprising the steps of:

increasing the temperature of the substrate holder, including:

activating a heating component, and

effectively reducing a thermal mass of the substrate holder to be heated by the heating component; and

decreasing the temperature of the supporting surface, including:

activating a cooling component, and

increasing a thermal conductivity between the heating component and the cooling component.

23. The method of Claim 22, wherein the substrate holder includes a contact volume positioned between a heating component and a cooling component.

24. The method of Claim 22 , wherein the step of effectively reducing the substrate holder thermal mass includes evacuating a fluid from the contact volume.

25. The method of Claim 22 , wherein the step of increasing the thermal conductivity includes filling the contact volume with the fluid.

26. The substrate holder of Claim 1, wherein the fluid used in the contact volume is a gas.

27. The substrate holder of Claim 26, wherein the fluid is helium gas.

28. The substrate holder of Claim 7, wherein the distance between the first internal surface and the second internal surface is between 1 and 20 microns.

29. The method of Claim 18, wherein the distance between the first internal surface and the second internal surface within the contact volume is between 1 and 20 microns.

30. The substrate holder of Claim 9, wherein the grooves on the two internal surfaces are arranged identically and opposite to each other.

31. The substrate holder of Claim 9, wherein the grooves on the two internal surfaces are arranged identically and shifted relative to each other.

32. The substrate holder of Claim 9, wherein the grooves on the two internal surfaces are arranged in different configurations.

33. The substrate holder of Claim 9, wherein all grooves are connected in a single zone system including at least one port to deliver and remove fluid to and from the grooves.

34. The substrate holder of Claim 9, wherein a set of grooves is connected together to form a first zone and at least one other set of grooves is connected together to form a second zone, with no connection between zones, wherein each of the first and second zones includes at least one port configured to deliver and remove fluid to and from the zone.

35. The substrate holder of Claim 1, wherein the heating component adjacent to the supporting surface is absent; the heating then is provided by the external heat flux, such, for example, as the heat flux from the plasma.

36. The substrate holder of Claim 1, further comprising at least one thermal sensor.

37. The substrate holder of Claim 1, further comprising:

an embedded electrostatic clamping electrode positioned adjacent to the supporting surface and above the contact volume;

connecting elements configured to provide direct current electric potential to the clamping electrode; and

a power supply.

38. The substrate processing system of Claim 11, further comprising:

a vacuum processing chamber in which the substrate holder is located; and

at least one process gas line entering the vacuum processing chamber.

39. The substrate processing system of Claim 38, wherein plasma is generated in the vacuum processing chamber.